WE CLAIM:

1. A transmitter, comprising:

an upconverter for converting one frequency signal to another frequency signal; and

a compensator for compensating at least one of gain distortion and phase distortion introduced into the one frequency signal by at least the upconverter.

2. The transmitter of claim 1, wherein

the upconverter is a direct upconverter for directly upconverting a baseband signal to an RF signal; and

the compensator compensates for at least one of gain imbalance and phase imbalance introduced into the baseband signal by at least the direct upconverter.

3. The transmitter of claim 2, wherein the baseband signal includes in-phase and quadrature phase components.

4. The transmitter of claim 3, wherein the compensator compensates for dc offset introduced into the baseband signal by at least the direct upconverter.

5. The transmitter of claim 3, wherein the compensator includes a filter unit compensating for gain/phase imbalance in the in-phase components and gain/phase imbalance in the quadrature phase components.

6. The transmitter of claim 5, further comprising:

a compensator constructor, based on a channel model of at least the direct upconverter that includes an in-phase channel, a quadrature phase channel and cross coupling channels between the in-phase and quadrature phase channels, estimating the in-phase channel, the quadrature phase channel, and the cross coupling channels between the in-phase and quadrature phase channels, and constructing filters in the filter unit based on the estimates.

7. The transmitter of claim 6, wherein the compensator constructor derives the filters as an inverse of the channel model for the direct upconverter based on the estimates and a cost function, which represents a mean squared error, in the frequency domain, between a desired response of a system including at least the direct upconverter and an actual response of the system including at least the filters and the direct upconverter.

8. The transmitter of claim 6, wherein the compensator constructor estimates each of the of the in-phase channel, the quadrature phase channel, and the cross coupling channels between the in-phase and

quadrature phase channels based on output from the compensator and a baseband signal derived from output of the direct upconverter.

9. The transmitter of claim 8, further comprising:

a feedback path including a down converter down converting output of the upconverter; and wherein

the compensator constructor receives a signal on the feedback path.

10. The transmitter of claim 8, further comprising:

a power amplifier amplifying the RF signal for transmission;

a feedback path including a down converter down converting output of the power amplifier; and wherein

the compensator constructor receives a signal on the feedback path.

11. The transmitter of claim 5, wherein the compensator compensates for dc offset introduced into the baseband signal by at least the direct upconverter.

12. The transmitter of claim 1, wherein the compensator includes at least one filter modeled as an inverse of a channel model for at least the upconverter, the inverse of the channel model derived from a cost function, which represents a mean squared error, in the frequency domain, between a desired response of a system including at least the upconverter and an actual response of the system including at least the filter and the upconverter.

13. The transmitter of claim 1, wherein the compensator compensates for dc offset introduced into the lower frequency signal by at least the upconverter.

14. A transmitter, comprising:

a direct upconverter for converting a baseband signal directly to an RF signal, the baseband signal including in-phase and quadrature phase components;

a first filter for filtering the in-phase component to compensate for at least one of gain imbalance and phase imbalance in the in-phase component;

a second filter for filtering the quadrature phase component to compensate for at least one of gain imbalance and phase imbalance in the in-phase component associated with cross-coupling of the quadrature phase component with the in-phase component;

a third filter for filtering the quadrature phase component to compensate for at least one of gain imbalance and phase imbalance in the quadrature phase component; and

a fourth filter for filtering the in-phase component to compensate for at least one of gain imbalance and phase imbalance in the quadrature component associated with cross-coupling of the in-phase component with the quadrature component.

15. The transmitter of claim 14, further comprising:

a first adder adding output of the first and second filters;

a second adder adding output of the third and fourth filters; and wherein

the direct upconverter receives output from the first and second adders.

16. The transmitter of claim 15, further comprising:

a third adder adding a first dc offset to the in-phase component to compensate for dc offset introduced into the baseband signal by at least the direct upconverter; and

a fourth adder adding a second dc offset to the quadrature phase component to compensate for dc offset introduced into the baseband signal by at least the direct upconverter; and wherein

the direct upconverter receives output from the third and fourth adders.

17. A method of generating an RF signal, comprising:

up converting one frequency signal to another frequency signal; and

compensating for at least one of gain andphase distortion introduced into the one frequency signal by at least the upconversion.

18. The method of claim 17, further comprising:

compensating for dc offset introduced into the lower frequency signal by at least the upconversion.

19. The method of claim 18, wherein the up converting step directly up converts a baseband signal to the RF signal.

20. A method of constructing a compensator for compensating gain/phase distortion produced by an upconverter, comprising:

deriving at least one filter as an inverse of a channel model for at least the upconverter based on a cost function, which represents a mean squared error, in the frequency domain, between a desired response of a system including at least the upconverter and an actual response of the system including at least the filter and the upconverter.

21. A method, comprising:

receiving a signal having been compensated for at least one of gain distortion and phase distortion introduced into the one frequency signal.